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ABSTRACT

The purpose of this study was to see if a relationship between color sensitivity and skin pigmentation would affect performance on the WISC block design subtest when both the standard red/white design and the blue/yellow design were used. It was hypothesized that the white children would perform better overall because black children have been found to be poor in spatial skills and because the great fundus pigmentation of the black children should make them less sensitive to blue, based on findings that greater fundus pigmentation creates less sensitivity to the short wave end of the spectrum. Eighty children, 40 white and 40 black, were given the block design task in natural lighting on a cloudy day. Half of each racial group were given the red/white design and half the blue/yellow design. Results were significant in the predicted direction. White children were not affected by the block designed color, while the scores for black children were significantly different on the blue/yellow design. Scores for the two races were not significantly different for the red/white design. Part of the experiment has been replicated under good lighting conditions with black children. Data have not been completely analyzed, but it appears that the performance difference between red/white and blue/yellow is not significant. (KM)

Block Design Test Performance As A Function Of Race and Block Color

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Variations in Mueller-Lyer sensitivity across cultures were first noted by Rivers in 1905, but not until 1966 was there an attempt to account for these variations in a systematic manner. In 1966, Segal, Campbell and Herschovitz put forth the hypothesis that the lesser sensitivity to the Mueller-Lyer illusion for non-Europeans could at least be partially accounted for in terms of the 'carpenteredness' of the subjects world.

Subsequent studies of the relationship between Mueller-Lyer sensitivity and 'carpenteredness' found only qualified support for the 'carpentered world' hypothesis.

In 1963, Pollack found a correlation between contour sensitivity and magnitude of the Mueller-Lyer illusion. He also found that contour sensitivity decreased as a function of age and he proposed that this loss of efficiency was a function of age related increases in the density of the fundus pigmentation.

In 1967, Pollack and Silvar determined that there was a correlation between skin pigmentation and the density of fundus pigmentation and in a further study they found a correlation between high fundus density and lack of sensitivity to the Mueller-Lyer illusion, in short darkly pigmented children saw less of an illusion.

Later support for the notion that fundus pigmentation could account for lack of sensitivity to the Mueller-Lyer illusion was reported by Berry in 1971. He reanalyzed data from work done in 1966 and 1969 and found that the relationship of skin pigmentation

to Mueller-Lyer sensitivity was .82 as compared to .64 for skin pigmentation and 'carpenteredness' of the environment.

Ishak, in 1952, found that differences in macular pigmentation showed greater sensitivity in the short-wave region of the visible spectrum. Fitzpatrick, 1964, and Eckhardt, 1966, confirmed the findings of Ishak. Both Fitzpatrick and Eckhardt were at Fordham and both measured sensitivity to wave length in subjects with varying fundus pigmentation.

In 1971, Jahoda used Scottish and Malawi students of geography to test spatial skills as they related to color and to compare the sensitivity of these two populations to red and blue Mueller-Lyer illusions. He used an open viewing situation for the presentation of the illusion, and each subject saw the card with the illusion on it for approx. ½ seconds. He found significantly less sensitivity to the blue M-L than to the red among the Malawi subjects.

The purpose of the present study was to see if a relationship between color sensitivity and skin pigmentation would affect performance on the WISC block design sub-test when both the red/white design (which is standard) and the blue/yellow design were used. He hypothesized that the white children would perform better overall than the black children because this task is considered by Weschler to be a test of spatial skills and Feldman and Farnham-Diggory (among others) have found black children to be poor in

spatial skills. Further, we felt that the black children would perform better on the red/white design than on the blue/yellow design because their greater fundus pigmentation should make them less sensitive to blue, based on the findings that greater fundus pigmentation creates less sensitivity to the short wave end of the spectrum.

The experiment was done in a rural school in Northeast Ga., and the testing took place in a little used hallway very near a door which was about half window. This was the only place that was available in the school that could meet the requirement that natural lighting be used. All four testing days were very cloudy but the lighting was adequate for the tester to read instructions with no difficulty.

The block design task was presented and scored in the standard manner to 80 children, 40 white and 40 black. To each group of 40, half were given the red/white design and half the blue/yellow design. In other words, 20 white children did the red/white design and 20 the blue/yellow; 20 black children did the red/white design and 20 the blue/yellow.

All of the protocols of the WISC black design administration were observed and the resulting raw scores were converted to scaled scores, based on age, and obtainable in the WISC manual.

Subjects were screened for aptitude prior to testing on the

basis of the California Test of Mental Maturity scores and the range of scores used was 70 to 113.

The results were significant in the predicted direction.

A factorial analysis of covariance was performed to eliminate the influence of "IQ" on the block design performance.

As can be seen in figure 1, the white children were not affected by the block design color. The black children were affected and the Tukey method for multiple comparisons shows that this difference was significant at the .01 level, using the corrected means.

The analysis of covariance which partialed out the influence of "IQ" showed significant differences for A, race, B, design color and a significant interaction. The multiple comparisons showed that the significant main and interaction effects were due to the scores of the black children on the blue/yellow design. The performances of the black and white children on the red/white design were <u>not</u> significantly different.

To summarize, this was an experiment done in a natural viewing situation to investigate the influence of fundus pigmentation on performance. The choice of the black design was not arbitrary. Berry had used the original Kohs block design to investigate spatial skills in his 1966 and 1969 studies and found a relationship between Mueller-Lyer sensitivity and performance on the Kohs blocks in the

1971 re-analysis of his earlier data.

Under less than optimal lighting conditions there was a significant difference in the performance of the black children on the red/white design compared to the blue/yellow design. Other results were in the predicted direction.

I have recently replicated part of the experiment under good lighting conditions, using 10 children per condition and using only black children. Time has not allowed for a complete analysis of this data, but it appears that the performance difference between the two design colors, red/white and blue/yellow is not significant.

It may well be that increasing the intensity of illumination will eliminate the population difference on the blue/yellow condition. An experiment has been designed to test this notion under an artificial light source and with calibrated filters.

The major significance of this study is to make worthwhile the parametric study of the effects of such stimulus variables as luminance, lightness and hue contrast, and saturation in their interaction with population determined optical functions. The results of such experimentation may have significant consequences for physical lighting and the materials used in early childhood education.

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BLOCK DESIGN TEST PERFORMANCE AS A FUNCTION OF RACE AND BLOCK COLOR

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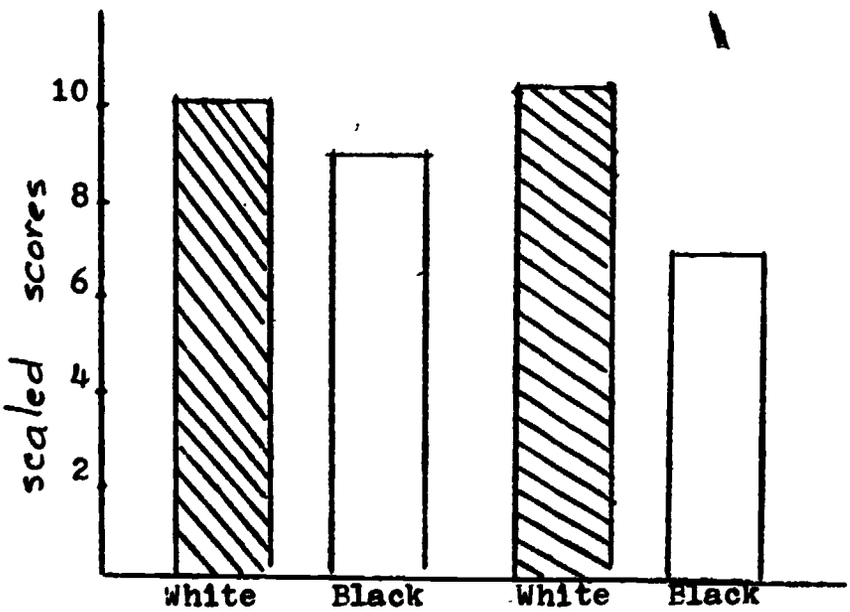

FIGURE 1: WISC block design subtest scaled scores as a function of race and hue. Scores are as adjusted for IQ.

		Y			Y'		
Source	df	Ms	F		Ms	F	
A	1	103.51	27.38	$p < .001$	44.89	12.26	$p < .001$
B	1	15.31	4.05	$p < .05$	15.26	4.17	$p < .05$
AXB	1	25.31	6.70	$p < .025$	23.53	6.43	$p < .025$
error	75	3.78			3.66		

TABLE 1: Analysis of covariance for race by design with IQ factored out.